PCT

WORLD INTELLECTUAL PROPER
International Bur

INTERNATIONAL APPLICATION PUBLISHED UNDER '

WO 9608884A1

(51) International Patent Classification 6 :
H04B 7/24

A1

(11) International Publication Number: WO 96/08884

(43) International Publication Date: 21 March 1996 (21.03.96)

(21) International Application Number: PCT/CA95/00518

(22) International Filing Date: 14 September 1995 (14.09.95)

(30) Priority Data:
2,132,180 15 September 1994 (15.09.94) CA

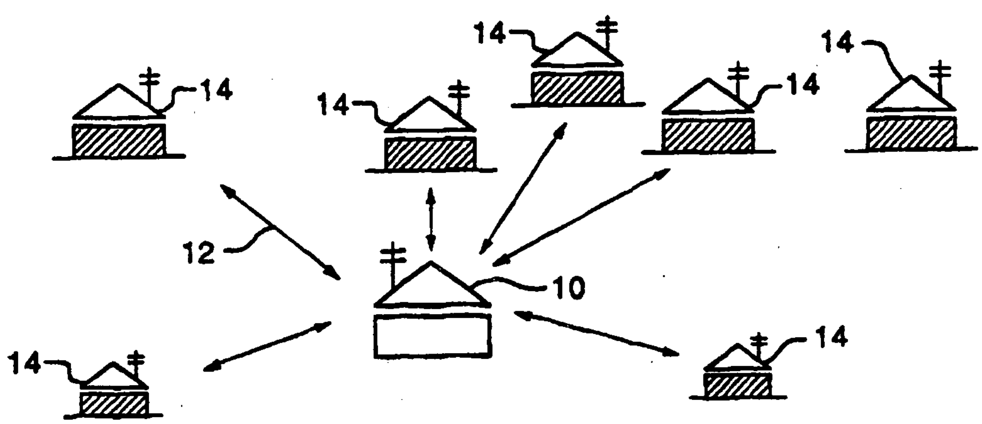
(71)(72) Applicant and Inventor: PI' ROBON, Victor [CA/CA]; 174 Betty Ann Drive, North York, Ontario M2N 1X6 (CA).

(74) Agents: JEFFREY, John, C. et al.; Suite 301, 133 Richmond Street West, Toronto, Ontario M5H 2L7 (CA).

(81) Designated States: CN, JP, MX, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: MASSIVE ARRAY CELLULAR SYSTEM



(57) Abstract

The present invention provides for a massive array cellular system consisting of an electromagnetic transceiver capable of simultaneously sending and receiving electromagnetic signals of multiple frequency. The transceivers are also capable of communicating with each other to relay electromagnetic signals of multiple frequency from one transceiver to another. The present invention also provides for individual massive array cellular system devices and for the protocol for the operation of the devices.

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TITLE: MASSIVE ARRAY CELLULAR SYSTEM

FIELD OF THE INVENTION

The present invention relates to a massive array cellular system and devices used in the system capable of simultaneously sending and receiving electromagnetic signals of multiple frequency.

BACKGROUND OF THE INVENTION

Present telephone and cellular systems of communication available for the general public typically require the purchase of a telephone or cellular phone and a fee for connecting to the telephone service. The physical lines and cellular systems belong to the telephone company and the user pays a fee for access to the service for transmission and reception of signals. The telephone companies transmit the signals by various means (microwave, conductive or fibre lines), charging the user a fee. At the present time cellular telephone systems utilize multiple cells which communicate with the cellular phone, the cellular phone communicating with the closest cell providing the strongest signal. These cells are then connected to the physical transmission medium of the telephone company.

SUMMARY OF THE INVENTION

The present invention provides for a massive array cellular system device comprising an electromagnetic transceiver capable of simultaneously sending and receiving electromagnetic signals of multiple frequency, the transceivers also being capable of communicating with another such device to relay electromagnetic signals of

multiple frequency from one transceiver to another. The present invention also provides for a massive array cellular system comprising a plurality of the devices and for the protocol for the operation of the devices.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are shown in the drawings, wherein:

Figure 1 illustrates the initialization of the M.A.C.S. device;

Figure 2 illustrates the connection request and relay for the M.A.C.S. device;

Figure 3 illustrates the operation of a mobile M.A.C.S. device;

Figure 4 illustrates the mobile M.A.C.S. device connecting to stationery M.A.C.S. devices for relaying to existing telephone service company services;

Figure 5 illustrates mobile M.A.C.S. devices communicating with stationery M.A.C.S. devices for the purpose of connecting to other M.A.C.S. devices; and

Figure 6 illustrates a typical topology of M.A.C.S. devices with out of range repeaters.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The Massive Array Cellular System (henceforth referred as M.A.C.S.) devices, protocols, and topologies comprise a cost effective alternative to current telephone and telecommunications company provided communication services. Typically this system and devices allow both private households or companies having these M.A.C.S. devices to interlink for the purpose of relaying signals from other Massive Array Cellular System (M.A.C.S.) devices for the purpose of multimedia communications (i.e.,

voice and video, television, voice, data or any other form of digital or analog signals).

The M.A.C.S. devices consist of electromagnetic transceivers capable of simultaneously sending and receiving electromagnetic signals of multiple frequencies. The M.A.C.S. devices are connected to various input and output devices, such as one or more multimedia devices (e.g. microphones, speakers, video cameras, computers, etc.). The M.A.C.S. devices and protocols utilize many electromagnetic channels of relative small wattage. Because the specific electromagnetic wavelengths and maximum signal strengths will likely be government regulated, their specifications are not being set herein. To compensate for limited frequency channels, the M.A.C.S. devices may utilize digital compression technology. For some multimedia communications, the M.A.C.S. devices may also incorporate digital signal processing. Each of the individual channels may have varying strengths to optimize on long distance hops to other M.A.C.S. devices, thus minimizing the number of routing connections required to establish a final destination M.A.C.S. device link.

Each M.A.C.S. device is able to simultaneously process multiple channels. Most of these channels are used to relay the signals of other M.A.C.S. devices to their destination M.A.C.S. device. Each household/company having a M.A.C.S. device is able to originate a request to connect to a far distant M.A.C.S. device via other relaying M.A.C.S. devices as will be described further below.

The primary method of navigation of the signals is based on geo-physical locating coordinates of the devices (i.e. longitude and latitude or UTM or other such geo-physical coordinate system). An M.A.C.S. device is addressed by a geo-physical co-ordinate location and device identity, such that the combination is unique. This

address will henceforth be referred as LOC-Name. For validation and security the M.A.C.S. device LOC-Name may also have a password unique to the LOC-Name.

The M.A.C.S. protocols are used for the establishment of original two way connections to remote household/company M.A.C.S. devices, as well as to distribute signals to other M.A.C.S. devices. Each user of such M.A.C.S. device would be able to send and receive calls or multimedia communication relatively free of communication service charges.

A sub-set function of the M.A.C.S. devices and M.A.C.S. protocols is for the purpose of providing mobile connections to household/company M.A.C.S. devices, co-operating to connect to an existing communication service company.

Another sub-set function of the M.A.C.S. devices and protocols is for the inter-communication system for traffic vehicles (land, air or water vehicles) for the purpose of accident prevention, and high speed navigation.

The M.A.C.S. devices and protocols have the capacity of providing new videophone or other multimedia services.

The M.A.C.S. protocols are used to establish links between M.A.C.S. devices that may be separated and connected by other M.A.C.S. devices.

After establishment of the initial originating M.A.C.S. device to destination M.A.C.S. device link, subsequent connections of M.A.C.S. devices may be navigated by previous successful navigational links or by provided routing instructions sent by the originating M.A.C.S. device. The M.A.C.S. protocols also allow for navigation

alternatives in case an intermediate M.A.C.S. device link fails or for lack of available channels on an intermediate M.A.C.S. device.

The M.A.C.S. protocols cover the basic methods for M.A.C.S. device initialization routines, relaying or repeating of communications between M.A.C.S. devices, mobile M.A.C.S. devices communication links, and M.A.C.S. devices addressing. Various figures are attached and explained below to illustrate the M.A.C.S. devices, protocols, and topologies and their operation.

M.A.C.S. DEVICE INITIALIZATION:

As illustrated in Figure 1, on power up or first time activation the M.A.C.S. device 10 requires a LOC-Name. This Loc-Name may be a user entered set of geo-physical co-ordinates (e.g.: longitude, latitude or UTM), and a user or M.A.C.S. devices identity (e.g.: company name, personal name, Personal Identity Number, S.I.N., etc.). The user of the M.A.C.S. device 10 may enter an access password for encryption, access authorization, and security.

The M.A.C.S. devices 10 having the above manually entered or device calculated geo-location first broadcasts a Request for Neighbour-Hood-Nodes 12. The nearest M.A.C.S. devices 14 will respond with their Loc-Names. The requesting M.A.C.S. device 10 then stores these nearest and most immediate neighbouring M.A.C.S. devices' information for future routing strategies for the purpose of relaying or repeating communications to and from other M.A.C.S. devices 14.

Since many M.A.C.S. devices may be in one building, the M.A.C.S. devices 10 begin first by using a signal transmission strength of a few meters radius in its broadcast for Requests for Neighbour-Hood-Nodes 12, waits

for responses and slowly increments transmission wattage or signal strength until a sufficient number of surrounding M.A.C.S. devices 14 respond, achieving maximum number of clear channels as well as directionally diverse neighbouring M.A.C.S. devices 14.

If a M.A.C.S. device LOC-Name geo-position does not fit within the signal radius of other M.A.C.S. devices LOC-Name geo-positions then the other M.A.C.S. devices will ignore all communications to the illicit device. This should prevent the unauthorized reception of signals.

M.A.C.S. DEVICE REQUEST FOR CONNECTION, AND M.A.C.S. DEVICE COMMUNICATION RELAY/REPEAT:

As illustrated in Figure 2, having the LOC-Name of the M.A.C.S. device 16 to connect to, a request for connection is transmitted to the neighbouring M.A.C.S. devices 14 (determined by the above initialization routine) by sending the desired LOC-Name and it's own originating LOC-Name 18. The subsequent M.A.C.S. device 14 will also pass the relaying station LOC-Name 20, since it is not the originator. As an example, if the desired Loc-Name geo-position is north-west of the originating request, the originating M.A.C.S. device 10 would request the M.A.C.S. device 14 closest to the north-west destination to be the relaying M.A.C.S. device of its transmission. This relaying M.A.C.S. device would reply that it has a channel to relay its communication. The originating M.A.C.S. device 10 confirms receipt of message, and stores the first level relay routing destination M.A.C.S. device 14 LOC-Name. The relaying M.A.C.S. device 14, if not the final destination M.A.C.S. device 16, in turn would relay the original request 22 with the desired destination M.A.C.S. device LOC-Name, the origin M.A.C.S. device LOC-Name, and the relaying M.A.C.S. device LOC-Name, to its neighbourhood

M.A.C.S. devices 24. This process would repeat and continue until the final destination M.A.C.S. device is contacted. Once the final destination M.A.C.S. device responds then the relay of communication 26 begins both ways from-to originating (origin) M.A.C.S. device and destination M.A.C.S. device via the interlinking and relaying M.A.C.S. devices.

In cases where a M.A.C.S. device(s) connection fails, a back-tracking and re-routing via the Request for Connection as described above is done until a final destination M.A.C.S. device connection is again achieved. For the purpose of speed, the successful route may be memorized by the origin M.A.C.S. device, for subsequent re-connections to the destination M.A.C.S. device. The relaying M.A.C.S. device may transmit back to the origin M.A.C.S. device through the paths taken by the relaying M.A.C.S. devices for the origin M.A.C.S.'s future use.

Some channels may be reserved for the sole purpose of relaying one-way television or multimedia services to other M.A.C.S. devices in order to eliminate the need of cable service companies, television broadcasting, and satellite TV/multimedia transmission services.

MOBILE M.A.C.S. DEVICES COMMUNICATION TO STATIONARY M.A.C.S. DEVICES:

As illustrated in Figure 3, in this situation the originating first level connection 28 to a stationary M.A.C.S. device 10 becomes the origin M.A.C.S. device's 30 geo-location component of its LOC-Name for the returning communication from the desired destination M.A.C.S. device 16 or relaying M.A.C.S. device 14. The first stationary M.A.C.S. device 10 takes on the function of representing

the mobile M.A.C.S. device's 30 LOC-Name. When the mobile M.A.C.S. device 30 begins to physically pass beyond the signal area of the first level connection stationary M.A.C.S. device 10 as shown by arrow 36, the mobile M.A.C.S. device 30 requests another stationary M.A.C.S. device within its signal area to become the origin M.A.C.S. device LOC-Name and its first level connection as represented by crooked arrow 38 to insure a reliable communication channel. The previous stationary M.A.C.S. device 10 is informed of its desire to use another stationary M.A.C.S. devices to represent it as the origin M.A.C.S. device Loc-Name. The previous stationary M.A.C.S. device 10 in turn informs the next level relaying M.A.C.S. device to communicate to the new origin M.A.C.S. device's LOC-Name. If any of the relaying M.A.C.S. devices 14 becomes out of service, out of signal range, or out of free relaying channels then a re-routing backwards and forward to the new M.A.C.S. device is performed. Password verification can be relayed to the users stationary M.A.C.S. device to authorize the mobile M.A.C.S. device's reception of signals that would normally be sent to the users stationary M.A.C.S. device.

MOBILE M.A.C.S. DEVICE CONNECTION TO STATIONARY M.A.C.S. DEVICES FOR RELAYING TO EXISTING TELEPHONE SERVICES:

As illustrated in Figure 4, a secondary function of the M.A.C.S. devices 10 would be to relay a mobile M.A.C.S. device 30 communication via stationary M.A.C.S. devices 10 via a traditional telephone service company to a location 34 having only a traditional telephone line 32 by allowing the mobile M.A.C.S. device 10 to send its telephone service charge account number to the telephone company system for validation and have all such telephone charges charged to the user of the mobile M.A.C.S. device's 30 telephone number. The stationary M.A.C.S. device 10

would feed the mobile M.A.C.S. device's 30 communication immediately into the existing Telephone Company services by hard wire 32 or other traditional telephone systems.

A mobile M.A.C.S. device may also request a relay from one Mobile M.A.C.S. device to another Mobile M.A.C.S. device which in turn will relay to another Mobile M.A.C.S. device using the geo-physical co-ordinates obtained by Geo-positioning satellites to determine their mobile geo-physical location for the purpose of navigating towards the direction of the destination LOC-Name. This allows the navigation of the relays to incorporate any mixture of Stationary and Mobile M.A.C.S. devices to achieve connection to the destination LOC-Name.

MOBILE M.A.C.S. DEVICES COMMUNICATION FOR INTER-VEHICLE NAVIGATIONAL AND SAFETY AND INTER-VEHICLE USER COMMUNICATIONS:

The mobile M.A.C.S. devices for such a function must have a means to re-calculate its geo-position or LOC-Name. With a geo-positioning resolution of better than few meters, vehicles can inter-communicate their speed, direction, vehicle conditions, braking conditions, passenger communication etc. to other signal area mobile M.A.C.S. devices. In cases where a vehicle, having a mobile M.A.C.S. device is in front of another mobile M.A.C.S. device equipped vehicle, that may suddenly brake, then the following vehicle can take appropriate measures to prevent collision. In cases of intersection crossing by such equipped M.A.C.S. device vehicles, the inter-communications of crossing vehicles can warn of an impending collision.

The proposed M.A.C.S. devices and system of the present invention provides numerous benefits. The system

eliminates the user need for telephone companies, television broadcasters, as well as television cable companies.

The M.A.C.S. protocols allow these M.A.C.S. devices to communicate with each other, navigate signals through the devices and relay various forms of communication from M.A.C.S. device to M.A.C.S. device as well as link to non M.A.C.S. devices.

The mobile and stationary M.A.C.S. devices, protocols and topologies will freely provide a massive multimedia throughput, personal multimedia communication, mobile cellular service, as well as vehicular (i.e., automotive) safety control.

As illustrated in part in Figure 6, the M.A.C.S. devices 10 and protocols allow the development of a network of millions of M.A.C.S. devices 10 distributed across various countries. The M.A.C.S. devices 10 would originate and relay among themselves data, videophone, television, and other multimedia broadcasts. The network of M.A.C.S. devices 10 include high power channels 44 as well as low power channels 42 and may also include the use of relay nodes 46.

The M.A.C.S. devices, protocol and topology based network would have strategic communications defence advantages. A man made or natural destruction of a city (or cluster of M.A.C.S. devices) would not permanently interrupt communications to other surrounding and remaining M.A.C.S. devices. The communications between M.A.C.S. devices would be relayed around the destroyed city or the bordering M.A.C.S. devices by increasing the transmission reception radius to span the deactivated M.A.C.S. devices, or relay signals around the deactivated area via other M.A.C.S. devices.

These M.A.C.S. devices network would have a combined multimedia throughput far surpassing any and all present communication company services.

Although various preferred embodiments of the present invention have been described herein in detail, it will be appreciated by those skilled in the art, that variations may be made thereto without departing from the spirit of the invention or the scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A massive array cellular device comprising an electromagnetic transceiver capable of simultaneously sending and receiving electromagnetic signals of multiple frequency, the transceiver also being capable of communicating with another such device to relay electromagnetic signals of multiple frequency from one device to another.

2. A massive array cellular system comprising a plurality of electromagnetic transceivers each of the transceivers being capable of simultaneously sending and receiving electromagnetic signals of multiple frequency, each of the transceivers also being capable of communicating with other nearby transceivers to relay electromagnetic signals of multiple frequency from one device to another.

3. A method of operating a massive array cellular systems consisting of a plurality of electromagnetic transceivers, each of the transceivers being capable of simultaneously sending and receiving electromagnetic signals of multiple frequency, each of the transceivers also having a unique address and being capable of communicating with other nearby transceivers to relay electromagnetic signals of multiple frequency from one device to another, the method comprising:

a) an originating device originates a signal transmission to a destination device by sending a request to a nearby device closest to the direction of the destination device to be the relaying device of its transmission,

b) the relaying device, if not the destination device, in turn relaying the original request with the desired destination device address, the originating device

address, and the relaying device address, to its nearby devices,

c) repeating the above steps until the destination device is contacted, and

d) relaying the communication between the originating device and the destination device via the relaying devices.

4. A method as claimed in claim 3 wherein the originating device acquires the addresses of nearby devices by the method comprising:

a) broadcasting a request for address to nearby devices,

b) receiving the unique addresses of the nearest and most immediate neighbouring devices, and

c) storing the addresses for future routing strategies for the purpose of relaying or repeating communications to and from other devices.

5. A method as claimed in claim 4 wherein the device in step a) first utilizes a signal transmission strength of a few meters radius in its broadcast for requests for address, waits for responses and slowly increments transmission wattage or signal strength until a sufficient number of nearby devices respond with addresses.

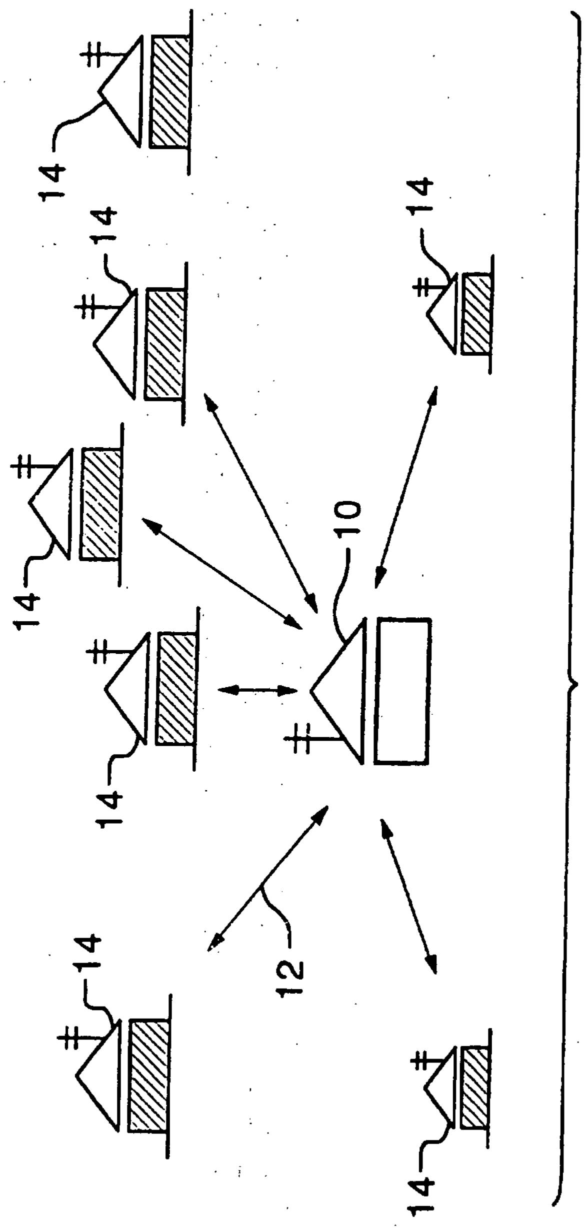

FIG.1

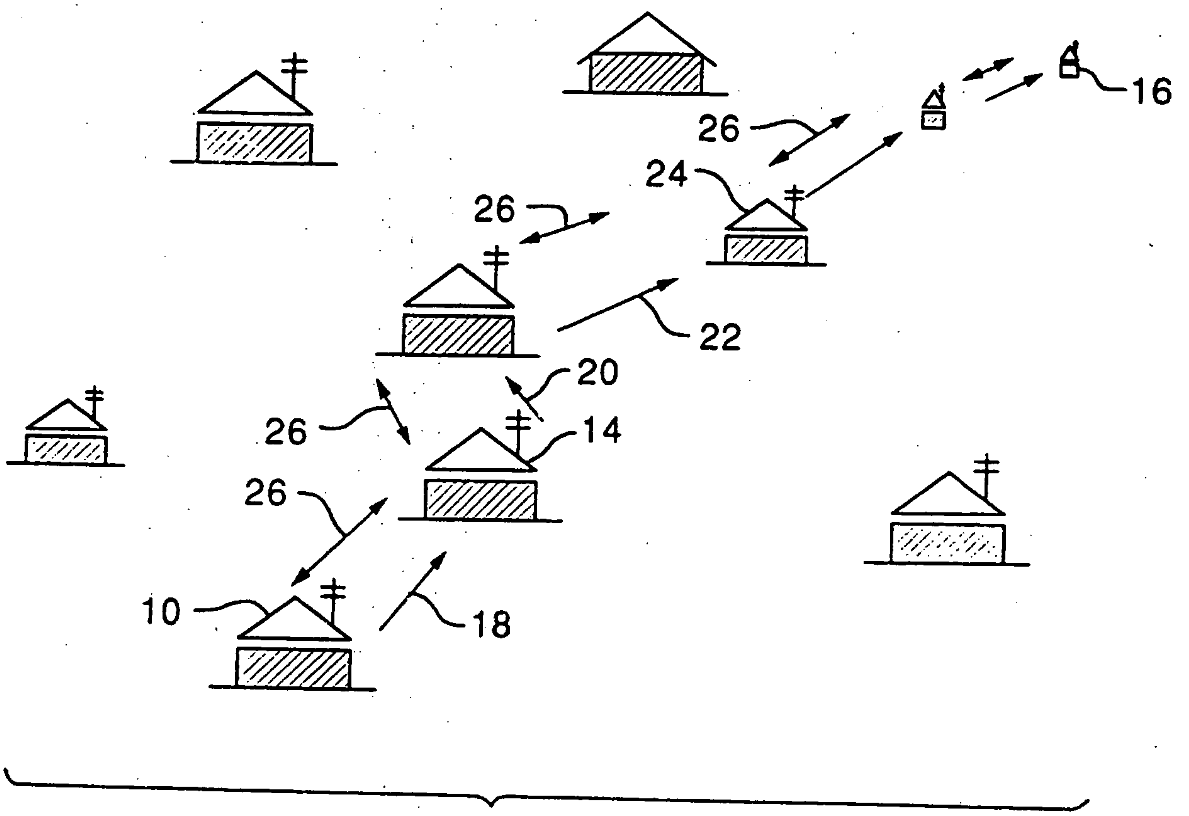

FIG.2

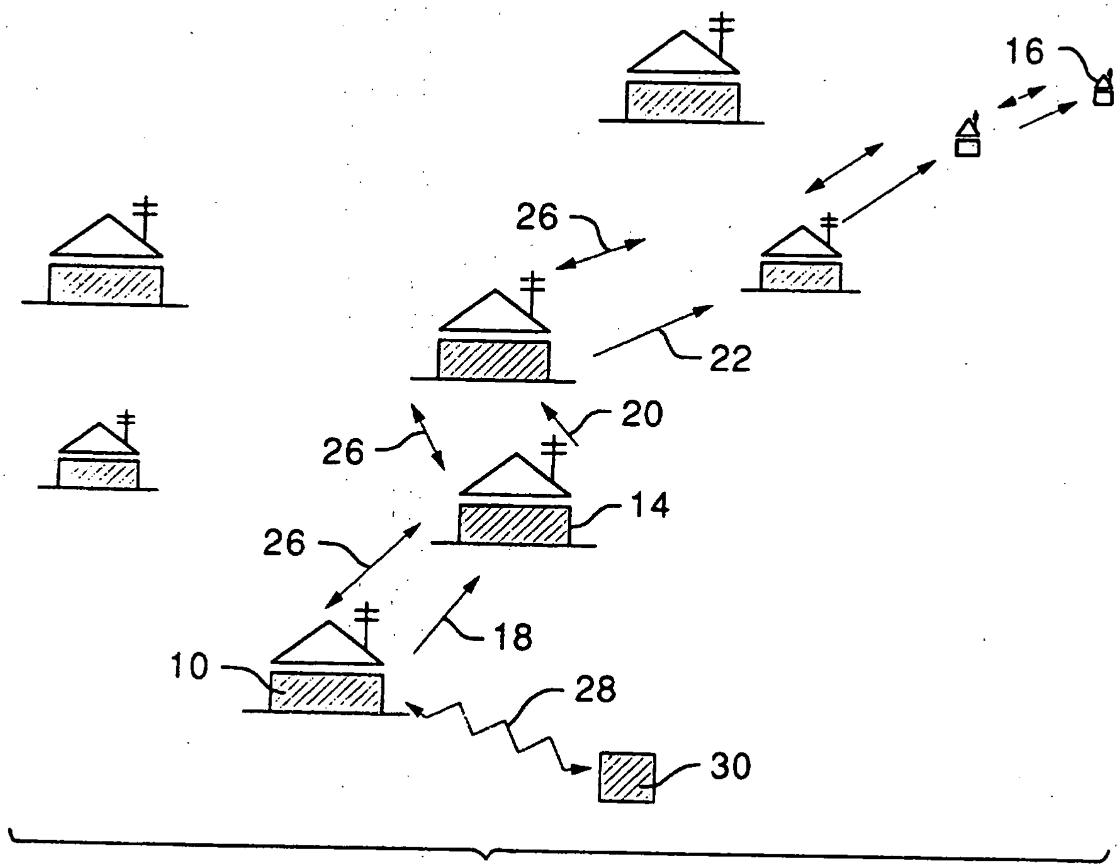

FIG.3

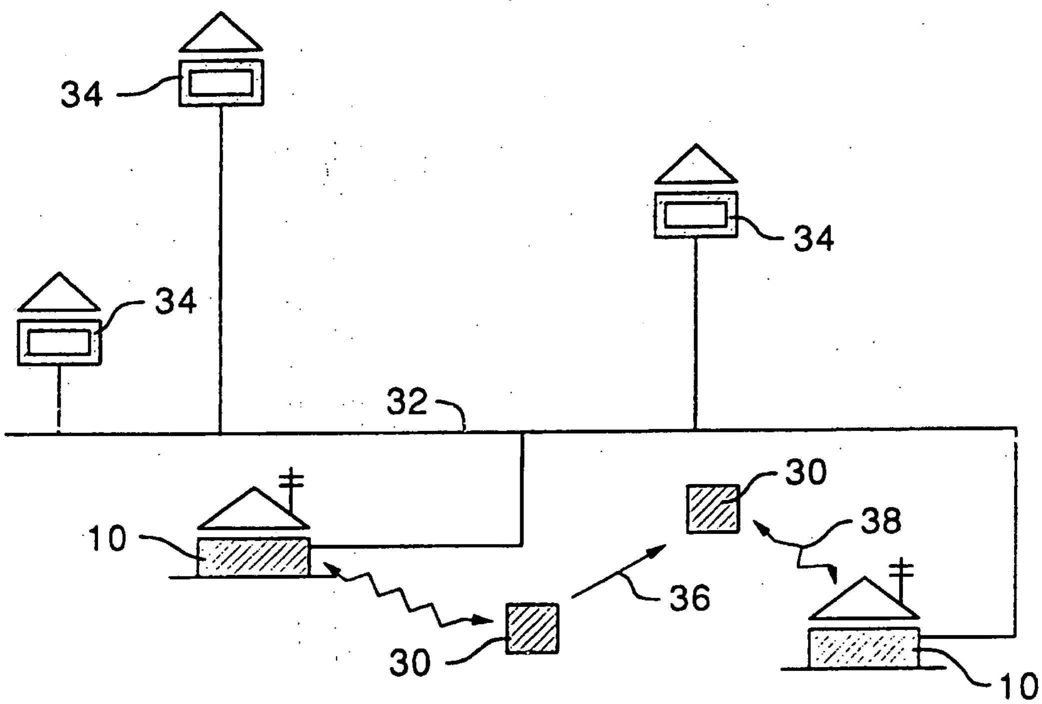

FIG.4

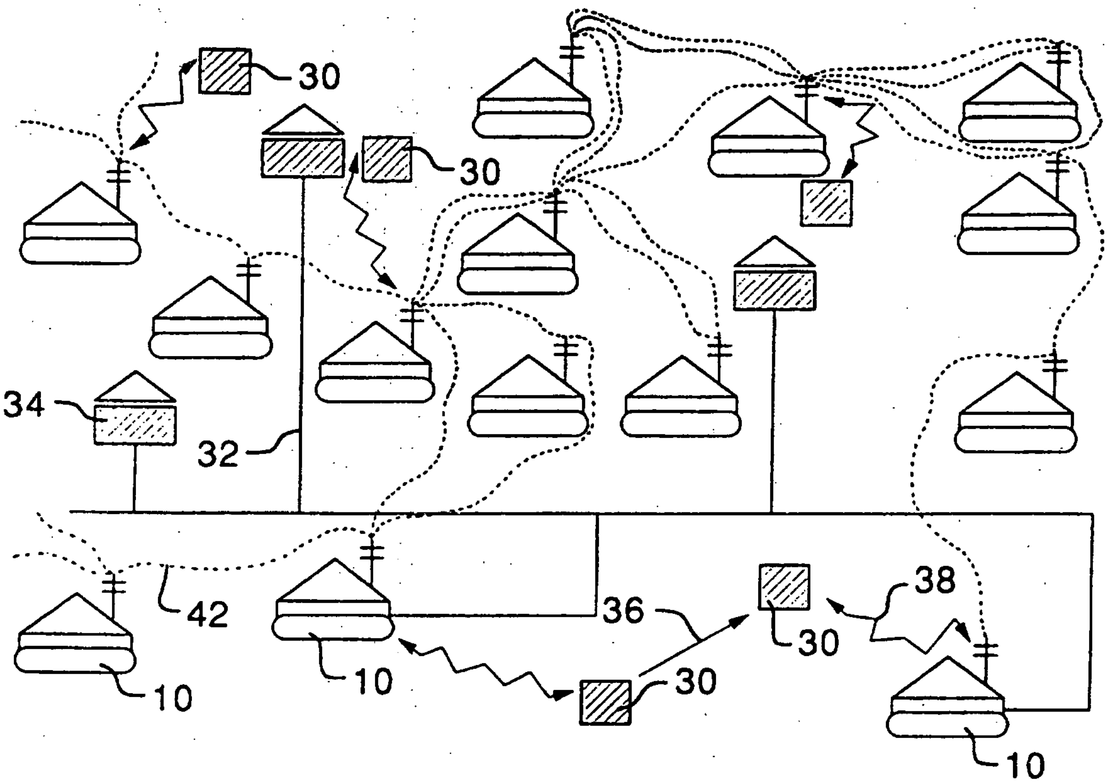

FIG.5

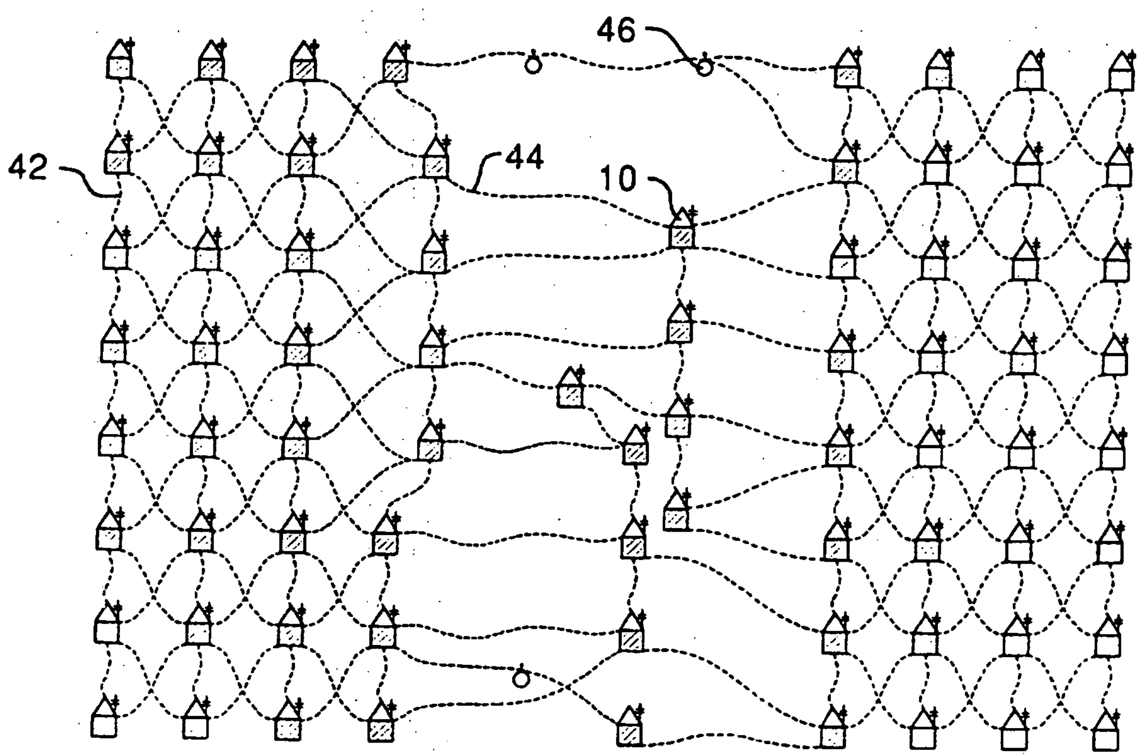

FIG.6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CA 95/00518

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04B7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04B H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,93 15565 (INVENTAHL AB) 5 August 1993 see page 1, line 3 - page 11, line 27	1,2
Y	see page 18, line 2 - line 4 see page 21, line 2 - line 3 ---	3-5
Y	EP,A,0 526 388 (CITY COMMUNICATIONS LIMITED) 3 February 1993 see claims 1-11 ---	3-5
A	DE,A,42 24 422 (ALCATEL SEL) 27 January 1994 see column 1, line 1 - column 3, line 37 ---	1-5
A	GB,A,2 261 575 (CSIR) 19 May 1993 see page 2, line 1 - page 8, line 2 ---	1-5

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[X] Further documents are listed in the continuation of box C.

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1

Date of the actual completion of the international search	Date of mailing of the international search report
3 January 1996	24.01.96

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Bischof, J-L

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/CA 95/00518

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A-9315565	05-08-93	AU-B-	3579093	01-09-93
		CN-A-	1105790	26-07-95
		EP-A-	0625294	23-11-94
		HU-A-	67995	29-05-95
		JP-T-	7507184	03-08-95
EP-A-526388	03-02-93	US-A-	5369784	29-11-94
DE-A-4224422	27-01-94	NONE		
GB-A-2261575	19-05-93	AP-A-	335	27-04-94
		OA-A-	9714	30-08-93
		ZA-A-	9208822	13-05-93
EP-A-557168	25-08-93	FR-A-	2687524	20-08-93
		CA-A-	2089847	20-08-93
		US-A-	5357503	18-10-94